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2019 Mississippi Commercial Fishery and Seafood Related Revenue Losses

Catastrophic Regional Fishery Disaster due to Extreme Flooding Events in the Gulf of Mexico

Executive Summary

Fishery Component	Revenue Losses
Blue Crab	\$393,460
Brown Shrimp	\$8,407,648
Bait Shrimp	\$160,804
Finfish	\$106,304
Oyster – Wild Fishery	\$35,179,878
Oyster - Aquaculture	\$1,706,250
Seafood Restaurants	\$15,203,334
Shrimp Processors	\$16,181,595
Oyster Processors	\$66,413,710
Blue Crab Processors	\$1,132,750
Seafood Markets	\$9,755,912
Charter Boats	\$4,536,000
Bait Shops	\$1,176,766
Tackle Shops	\$8,392,540
Total	\$168,746,951



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Mississippi Department of Marine Resources – Office of Marine Fisheries

Mississippi Commercial Fisheries Losses to Extreme Flooding Events in the Gulf of Mexico

2019 Catastrophic Regional Fishery Disaster

In 2019, extreme Mississippi River flooding resulted in the historic twice opening in one year of the Bonnet Carré Spillway (BCS) and the first consecutive year opening. The first 2019 opening was February 27 through April 11, with a maximum flow of 213,000 cubic feet per second (cfs). The spillway was opened a second time this year from May 10 through July 27, with a maximum flow of 161,000 cfs. The Mississippi Sound was inundated with freshwater from March through August. Fisheries have been severely impacted. On September 25, the United States Secretary of Commerce declared a 2019 Catastrophic Regional Fisheries Disaster for Mississippi, Louisiana, and Alabama. The following report was compiled by the Mississippi Department of Marine Resources (MDMR) to describe those decreased commercial fisheries landings impacts, as reported through trip tickets, specific to Mississippi's marine waters.

Fishery	Approximate Number Fishermen Affected*	Ex-Vessel Revenue Losses
Blue Crab	255	\$393,460
Brown Shrimp	423	\$8,407,648
Bait Shrimp	32	\$160,804
Finfish	428	\$106,304
Oyster – Wild Fishery	269	\$35,179,878
Oyster - Aquaculture	13	\$1,706,250
Total	1420	\$45,954,344

Table 1. Damages to Licensed Commercial Fishing Operations.

*May not include alternate captains or deckhands, typically unlicensed.

Blue Crab Fishery Disaster Impacts

The Mississippi Blue Crab Fishery experienced losses during and immediately following the 2019 BCS openings. Ex-vessel revenues (dockside values) were evaluated by comparing to the average dockside values for three of the previous five years. 2015, 2017 and 2018 were determined by MDMR staff to represent years where conditions were favorable for this fishery and the landings and values during these years were average or greater than average when compared to the overall 5-year period. Cumulative monthly dockside values from March to August were averaged for these years and the average was compared to the same 6-month period in 2019.

Cumulative losses in dockside value from March 2019 through August 2019 are \$215,244 (25.29%) below the same six-month period for the comparison years. Monthly and cumulative values and landings for 2019 as well as the comparison year averages are provided in Table 2.

	March	April	May	June	July	August
2019 Monthly Value	\$90,261	\$110,129	\$118,528	\$101,834	\$96,123	\$118,848
2019 Cumulative Value	\$90,261	\$200,390	\$318,918	\$420,752	\$516,875	\$635,723
2015, 2017, 2018 Average Monthly Value	\$156,128	\$125,040	\$132,463	\$140,202	\$158,295	\$138,839
2015, 2017, 2018 Average Cumulative Value	\$156,128	\$281,168	\$413,630	\$553,833	\$712,128	\$850,967
2019 Cumulative Loss in Value	-\$65,867	-\$80,778	-\$94,712	-\$133,080	-\$195,253	-\$215,244
Cumulative % Below 2015, 2017, 2018 Average	-42.19%	-28.73%	-22.90%	-24.03%	-27.42%	-25.29%

Table 2. 2019 Blue Crab Values vs. 2015, 2017, 2018 Values

The effects of this disaster will likely continue for this fishery at least until next year's adults recruit into the fishery. Due to the requirement of reporting losses within 60 days of the September 25, 2019 catastrophic regional fishery disaster declaration MDMR staff has also projected Blue Crab losses for an additional 6-month period.

Projected losses were calculated using the average monthly landings for the same comparison years that were used to assess actual losses – 2015, 2017 and 2018. For the purposes of this assessment these averages were assumed to be the benchmark standard monthly values for September 2019 through February 2020. A projected monthly percent loss was assigned at -25.29% based on the actual 6-month cumulative percent loss from March 2019 through August 2019.

Based on these calculations the cumulative projected losses in dockside value from September 2019 through February 2020 are \$178,216 below the same six-month period for the comparison years (2015, 2017 and 2018). Monthly and cumulative values and landings for 2019 as well as the comparison year averages are provided in Table 3.

	September	October	November	December	January	February
2015, 2017, 2018 Actual Average Monthly Value	\$77,627	\$76,087	\$70,443	\$122,353	\$176,493	\$181,574
2015, 2017, 2018 Actual Average Cumulative Values	\$77,627	\$153,714	\$224,157	\$346,510	\$523,003	\$704,577
2019-2020 Projected Monthly Value	\$57,992*	\$56,841*	\$52,625*	\$91,405*	\$131,851*	\$135,647*
2019-2020 Projected Cumulative Value	\$57,992*	\$114,833*	\$167,458*	\$258,863*	\$390,714*	\$526,361*
2019-2020 Projected Cumulative Loss in Value	-\$19,635*	-\$38,881*	-\$56,698*	-\$87,646*	-\$132,289*	-\$178,216*

Table 3. 2019-2020 Projected Blue Crab Values vs. 2015, 2017, 2018 Average Values

*represents a projected value/percent loss and not based on actual dockside values

The actual losses from March 2019 to August 2019 (-\$215,244) were combined with the project losses from September 2019 to February 2020 (-\$178,216) to estimate a total loss in dockside value to the Brown Shrimp fishery of -\$393,460.

Brown Shrimp Fishery Disaster Impacts

The BCS was opened on February 27, 2019 and its freshwater discharge is estimated to have reached the western Mississippi Sound around March 3, 2019.

The Mississippi Brown Shrimp Fishery experienced significant losses during and immediately following the 2019 BCS openings. Ex-vessel revenues (dockside values) were evaluated by comparing to the average dockside values for three of the previous five years. 2014, 2015 and 2017 were determined by MDMR staff to represent years where conditions were favorable for this fishery and the landings and values during these years were average or greater than average when compared to the overall 5-year period. Cumulative monthly dockside values from March to August were averaged for these years and the average was compared to the same 6-month period in 2019.

Cumulative losses in dockside value from March 2019 through August 2019 are \$6,252,818 (76.18%) below the same six-month period for the comparison years. Monthly and cumulative values and landings for 2019 as well as the comparison year averages are provided in Table 4.

	March	April	May	June	July	August
2019 Monthly Value	\$0	\$1,646	\$147,673	\$346,192	\$325,807	\$1,133,647
2019 Cumulative Value	\$0	\$1,646	\$149,319	\$495,511	\$821,319	\$1,954,966
2014, 2015, 2017 Average Monthly Value	\$74,314	\$107,502	\$302,029	\$3,072,566	\$2,015,218	\$2,636,154
2014, 2015, 2017 Average Cumulative Value	\$74,314	\$181,816	\$483,845	\$3,556,412	\$5,571,630	\$8,207,784
2019 Cumulative Loss in Value	-\$74,314	-\$180,170	-\$334,526	-\$3,060,900	\$4,750,310	\$6,252,818
Cumulative % Below 2014, 2015, 2017 Average	-100.00%	-99.09%	-69.14%	-86.07%	-85.26%	-76.18%

Table 4. 2019 Brown Shrimp Actual Values vs. 2014, 2015, 2017 Average Values

Due to the requirement of reporting losses within 60 days of the disaster declaration MDMR staff has also projected Brown Shrimp losses for an additional 6-month period. The effects of this disaster will likely continue for this fishery at least until next year's adults recruit into the fishery, which will likely occur in late Spring 2020.

Projected losses were calculated using the average monthly landings for the same comparison years that were used to assess actual losses – 2014, 2015 and 2017. For the purposes of this assessment these averages were assumed to be the benchmark standard monthly values for September 2019 through February 2020. A projected monthly percent loss was assigned at -76.18% based on the actual 6-month cumulative percent loss from March 2019 through August 2019.

Based on these calculations the cumulative projected losses in dockside value from September 2019 through February 2020 are \$2,154,830 below the same six-month period for the comparison years (2014, 2015 and 2017). Monthly and cumulative values and landings for 2019 as well as the comparison year averages are provided in Table 5.

	September	October	November	December	January	February
2014, 2015, 2017 Actual Average Monthly Value	\$1,563,047	\$629,397	\$334,551	\$158,913	\$110,849	\$31,846
2014, 2015, 2017 Actual Average Cumulative Value	\$1,563,047	\$2,192,444	\$2,526,996	\$2,685,908	\$2,796,757	\$2,828,604
2019-2020 Projected Monthly Value	\$372,318*	\$149,922*	\$79,690*	\$37,853*	\$26,404*	\$7,586*
2019-2020 Projected Cumulative Value	\$372,317*	\$522,240*	\$601,930*	\$639,783*	\$666,188*	\$673,773*
2019-2020 Projected Cumulative Loss in Value	-\$1,190,729*	-\$1,670,203*	-\$1,925,065*	-\$2,046,124*	-\$2,130,569*	-\$2,154,830*

Table 5. 2019-2020 Projected Brown Shrimp Values vs. 2014, 2015, 2017 Average Values

*represents a projected value/percent loss and not based on actual dockside values

The actual losses from March 2019 to August 2019 (-\$6,252,818) were combined with the project losses from September 2019 to February 2020 (-\$2,154,830) to estimate a total loss in dockside value to the Brown Shrimp fishery of -\$8,407,648.

Bait Shrimp Industry Disaster Impacts

The Mississippi bait shrimp industry experienced losses during and immediately following the 2019 BCS openings. Ex-vessel revenues (dockside values) were evaluated by comparing to the average dockside values for the previous five years – 2014 – 2018. Actual market values are not currently reported by this industry, so a subset of the industry was surveyed to determine an average cost per unit. Dockside values were assessed separately for live bait shrimp and dead bait shrimp sales due to the difference in cost per unit. Monthly dockside values from March to August were averaged for the previous years and the average was compared to the same 6-month period in 2019.

Cumulative losses in dockside value of live bait shrimp from March 2019 through August 2019 are - \$88,520 (-27.05%) below the same six-month period for the comparison years. Cumulative losses in dockside value of dead bait shrimp from March 2019 through August 2019 are -\$10,121 (-16.34%) below the same six-month period for the comparison years. The combined losses for live and dead bait shrimp for this 6-month period are -\$98,641. Monthly and cumulative values and landings for 2019 as well as the comparison year averages are provided for live bait shrimp in Table 6 and for dead bait shrimp in Table 7.

	March	April	May	June	July	August
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2019 Monthly Value	\$49,493	\$33,916	\$36,473	\$52,896	\$22,964	\$42,937
2019 Cumulative Value	\$49,493	\$83,409	\$119,882	\$172,778	\$195,741	\$238,679
2014-2018 Average Monthly Value	\$24,318	\$19,901	\$62,834	\$83,565	\$77,868	\$58,713
2014-2018 Average Cumulative Value	\$24,318	\$44,219	\$107,052	\$190,617	\$268,486	\$327,199
2019 Value Above/Below 5-year Cumulative Average	\$25,175	\$39,190	\$12,829	-\$17,839	-\$72,744	-\$88,520
Cumulative % Above/Below 2014-2018 Average	103.52%	88.63%	11.98%	-9.36%	-27.09%	-27.05%

Table 6. 2019 Live Bait Shrimp Values vs. 2014-2018 Values

	March	April	May	June	July	August
2019 Monthly Value	\$5,386	\$10,152	\$14,187	\$10,197	\$4,460	\$7,430
2019 Cumulative Value	\$5,386	\$15,537	\$29,724	\$39,921	\$44,381	\$51,811
2014-2018 Average Monthly Value	\$5,554	\$8,211	\$10,058	\$12,506	\$15,532	\$10,071
2014-2018 Average Cumulative Value	\$5,554	\$13,765	\$23,823	\$36,329	\$51,861	\$61,933
2019 Value Above/Below 5-year Cumulative Average	-\$169	\$1,772	\$5,900	\$3,591	-\$7,480	-\$10,122
Cumulative % Above/Below 2014-2018 Average	-3.03%	12.87%	24.77%	9.89%	-14.42%	-16.34%

Table 7. 2019 Dead Bait Shrimp Values vs. 2014-2018 Values

The effects of this disaster will likely continue for this industry at least until next year's Brown Shrimp adults recruit into the fishery. Due to the requirement of reporting losses within 60 days of the September 25, 2019 catastrophic regional fishery disaster declaration MDMR staff has also projected bait shrimp industry losses for an additional 6-month period.

Projected losses were calculated using the average monthly landings for the same 5-year period that was used to assess actual losses – 2014-2018. For the purposes of this assessment these averages were assumed to be the benchmark standard monthly values for September 2019 through February 2020. A projected monthly percent loss was assigned at -27.05% was used for live bait shrimp and -16.34% was used for dead bait shrimp based on the actual 6-month cumulative percent losses for each condition type from March 2019 through August 2019.

Based on these calculations the cumulative projected losses in dockside value from September 2019 through February 2020 are -\$57,812 for live bait shrimp and -\$4,353 for dead bait shrimp. The combined projected losses are -\$62,165. Monthly and cumulative values and landings for 2019 as well as the comparison year averages are provided in Table 8 for live bait shrimp and Table 9 for dead bait shrimp.

	September	October	November	December	January	February
2014-2018 Actual Average Monthly Value	\$58,315	\$53,129	\$47,446	\$24,409	\$13,636	\$16,756
2014-2018 Actual Average Cumulative Value	\$58,315	\$111,444	\$158,890	\$183,299	\$196,935	\$213,691
2019-2020 Projected Monthly Value	\$42,538*	\$38,756*	\$34,610*	\$17,806*	\$9,947*	\$12,223*
2019-2020 Projected Cumulative Value	\$42,538*	\$81,294*	\$115,904*	\$133,710*	\$143,657*	\$155,879*
2019-2020 Projected Cumulative Loss in Value	-\$15,776*	-\$30,150*	-\$42,986*	-\$49,590*	-\$53,279*	-\$57,812*

Table 8. 2019-2020 Projected Live Bait Shrimp Values vs. 2014-2018 Average Values

*represents a projected value/percent loss and not based on actual dockside values

	September	October	November	December	January	February
2014-2018 Actual Average Monthly Value	\$8,718	\$7,655	\$4,621	\$2,018	\$1,528	\$2,093
2014-2018 Actual Average Cumulative Value	\$8,718	\$16,373	\$20,994	\$23,012	\$24,540	\$26,634
2019-2020 Projected Monthly Value	\$7,294*	\$6,404*	\$3,866*	\$1,688*	\$1,278*	\$1,751*
2019-2020 Projected Cumulative Value	\$7,294*	\$13,697*	\$17,563*	\$19,251*	\$20,530*	\$22,281*
2019-2020 Projected Cumulative Loss in Value	-\$1,425*	-\$2,676*	-\$3,431*	-\$3,761*	-\$4,011*	-\$4,353*

Table 9. 2019-2020 Dead Bait Shrimp Projected Values vs. 2014-2018 Average Values

The actual losses from March 2019 to August 2019 (-\$98,641) were combined with the project losses from September 2019 to February 2020 (-\$62,165) to estimate a total loss in dockside value to the bait shrimp industry of -\$160,806.

Finfish Disaster Impacts

During analysis of commercial landings data, staff identified fifteen commercially viable species consistently harvested during the years represented in the below tables. The timeframe chosen during the analysis process represents months with the highest impact during the BCS opening and staff have identified this timeframe as the most representative of the potential losses in the fishery. The first table represents the biomass of each species harvested in the designated timeframe and the percent overall loss in average landings from March – June 2016-2018 when compared to March – June 2019 (Table 10). The second table (Table 11) represents the average value of each species along with the estimated value from each timeframe based on the biomass estimates. At the bottom of each table is a percent estimate of overall loss from the designated time period, which is estimated to be -58.4% for biomass and -45.21% for landings value.

Species	March-June 16-18	March-June 2019
Bluefish	1064.0	926.0
Jack Crevalle	446.7	173.0
Black Drum	5604.7	1836.0
Red Drum	13682.7	12198.0
Flounder	4364.7	4994.0
Whiting (Ground Mullet)	883.0	1574.0
Menhaden	22017.3	486.0
Striped Mullet	23501.0	6868.0
Silver Mullet	2514.3	73.0
Florida Pompano	835.7	70.0
Sea Catfish	2205.0	241.0
Spotted Seatrout	40055.7	18145.0
White Trout	927.7	484.0
Sheepshead	13839.3	3319.0
Spanish Mackerel	7663.3	6754.0
Total	139605.0	58141.0
Overall Loss	-58.4%	n/a

Table 10. Mississippi commercial finfish landings from fifteen commercially viable species during the March – June time period from 2016-2018 and 2019.

Description	Avg Value	March-June 16-18	March-June 2019
Bluefish	\$0.42	\$446.88	\$388.92
Jack Crevalle	\$0.40	\$178.67	\$69.20
Black Drum	\$0.71	\$3,979.31	\$1,303.56
Red Drum	\$2.52	\$34,480.32	\$30,738.96
Flounder	\$3.39	\$14,796.22	\$16,929.66
Whiting (Ground Mullet)	\$1.31	\$1,156.73	\$2,061.94
Menhaden	\$0.15	\$3,302.60	\$72.90
Striped Mullet	\$0.60	\$14,100.60	\$4,120.80
Silver Mullet	\$0.66	\$1,659.46	\$48.18
Florida Pompano	\$3.69	\$3,083.61	\$258.30
Sea Catfish	\$0.64	\$1,411.20	\$154.24
Spotted Seatrout	\$3.35	\$134,186.48	\$60,785.75
White Trout	\$1.30	\$1,205.97	\$629.20
Sheepshead	\$0.83	\$11,486.65	\$2,754.77
Spanish Mackerel	\$1.26	\$9,655.80	\$8,510.04
All Species Combined		\$235,130.50	\$128,826.42
Overall Loss		-45.21%	

Table 11. Estimated values of each finfish species from the biomass estimates represented in Table 10.

Mississippi Oyster Resource Impacts

Oysters in Mississippi state waters, like all the Gulf of Mexico states, are considered a keystone species. The federal government spends hundreds of millions of dollars each year to restore oyster resources across the country because it recognizes the value and importance to our environment and fisheries. In Mississippi, public oyster reefs have been in a steady decline since the 2011 opening of the BCS, which was declared a Federal Fisheries Disaster. As a result of this disaster declaration, MDMR received funds from NOAA to assist in restoration of Mississippi's oyster resources; however, these funds were not made available to the State until 2015, which coincided with the expiration of the oyster restoration permit that state had previously received. Upon receiving the disaster funds, the U.S. Army Corps of Engineers (USACE) made the decision that the existing permit held by MDMR for oyster restoration could not be extended and a new permit would need to be acquired, which began a two-year process and further delays in the State being able to start restoring valuable oyster resources that were lost during the fisheries disaster nearly six years prior. Finally, in 2017, the necessary permits were acquired and MDMR began immediate implementation of a 3-year plan to restore the oyster resources in Mississippi. From the start of implementation of the restoration plan, MDMR resource managers estimated approximately five years for the oyster resources to recover. In February 2019, year two of the oyster restoration and recovery process, MDMR was informed of the opening of the BCS.

The Mississippi oyster season typically does not open until October each year and may close as late as April the following year. Because the BCS did not open until February 27, 2019, mid-way through the 2018-2019 oyster season, many of the oyster harvest licenses sold during the last full 12-month license period were purchased well before any knowledge that the BCS may open or have impacts to the Mississippi oyster fishery. On September 17, 2019, the Mississippi Commission on Marine Resources

voted unanimously to not allow harvest from the public oyster reefs for the 2019-2020 oyster season. This action was taken due to the complete lack of resources that will be available for this season and most likely many seasons to come. Mississippi oyster fishermen have lost their livelihood for a period, which may endure for potentially the next eight years or more.

MDMR staff have collected a total of 174 one-minute dredge tow samples from February 7, 2019 through September 3, 2019, which indicated a gradual increase in oyster mortalities throughout the duration of the BCS openings and peaking during the second opening. Estimated oyster mortality for all size classes of oysters on the major reefs in the western Mississippi Sound was determined to be 96.9%, while the market-size class experienced nearly 100% mortality and the few surviving oysters were measured in the sub-market size class. Salinities across the Mississippi Sound, especially in the western region, were driven well below 5.0 ppt, in most areas below 1.0 ppt, from mid-March through mid-August. This exposed oysters to salinity levels well below scientifically proven lower metabolic tolerance limits that are known to cause high stress and eventual mortality as a result of prolonged exposure, especially at higher temperatures. Annual oyster reef assessments using diver-collected square meter samples were scheduled to begin in May 2019, but due to the occurrence of harmful algae blooms, presence of biotoxins in marine waters, and unknown health and safety risks associated with the freshwater diversions, those monitoring activities were postponed and eventually cancelled for 2019. In 2018, MDMR fisheries staff conducted an assessment of the major public oyster reefs in Mississippi. Scientists collected and analyzed data from 424 square meter dive samples from those oyster reefs. This assessment provided an estimate of 56,337 sacks of oysters on the public reefs, 27,261 sacks in the western Mississippi Sound and 29,076 in the eastern Mississippi Sound. Mortality as a result of excessive fresh water from the BCS opening caused approximately 96.9% mortality of oyster in the west, and approximately 63.8% mortality of oysters in the east. This resulted in a net loss of 44,965 sacks of market-sized oysters on public oyster reefs in the MS Sound. Based on these high mortalities it will require approximately five to eight years for a full recovery of the oyster resource, given no additional environmental stressors.

With a net loss of 44,965 sacks of market sized oysters, the dockside economic impact from the spillway opening on the oyster fishery is estimated at \$2,023,425, based on an average \$45/sack value from previous years. This only accounts for oysters large enough for commercial harvest (≥ 3 inches length) and does not consider value of loss of oysters below legal harvest limits (< 3 inches length).

In May 2015 MDMR received \$6.9 million from NOAA for oyster restoration to conduct a variety of fisheries restoration activities to mitigate impacts, restore/enhance habitat, monitoring activities and recovery efforts. Since receiving these funds, the BCS has opened an additional four times [2016, 2018, 2019 (x2)], negatively impacting all restoration efforts accomplished thus far. Of the \$6.9 million allocated to oyster restoration \$5.6 million has been spent to directly address the impacts from the 2011 opening; however, those efforts have been negated by this year's BCS openings.

The 2019 BCS openings not only effected the market-sized oyster population, but it had vast effects on the sub-market-sized oyster population, which will have lasting effects on future production and harvest for at least five to eight years. MDMR had begun restoration on almost 1,000 acres of oyster reefs in the western Mississippi Sound in 2017 and the data collected from those restoration areas indicated an

abundance of recruitment of juvenile oysters, excellent health, and rapid growth. MDMR predicts most of the restoration areas would have been healthy and poised to allow for a significant increase in commercial harvest for the 2019-2020 Mississippi oyster season. However, measuring how this event has impacted the future of our oyster fishery, which was recovering well, is very difficult. Estimates can be projected by analyzing effects from previous fisheries disaster declarations in Mississippi and measuring the impacts of restoration. To accomplish these projections, MDMR referenced data collected from restoration efforts and landings associated with the years post-Hurricane Katrina, which resulted in a >85% loss of oyster resources in Mississippi and was declared a Federal Fisheries Disaster. MDMR analyzed the recovery of the oyster resource by calculating the amount of cultch material (yd³) that was deployed post-hurricane and comparing that to oyster landings that occurred in the subsequent years post-implementation of restoration efforts. By creating a table and analyzing this data, MDMR was able to calculate a restoration/harvest coefficient that takes into account the amount of restoration effort (yd³ of cultch material deployed) and the number of sacks of oysters harvested as a result of those restoration efforts for the 5 years post-restoration implementation, which will be represented in Table 12.

Using the restoration/harvest coefficient developed in the Table 13, and illustrated in Figure 1, the coefficient can be applied to the most recent restoration efforts that had begun in 2017 and just been completed prior to the opening of the 2019 BCS event. This allows for a projection to be made on the theoretical harvest that would have been achieved during the first five years post-restoration as a result of the completed restoration efforts under normal environmental conditions. However, the effects from the 2019 BCS openings have been unprecedented and it is anticipated it will require longer for oyster resources to recover, as much as eight years. The restoration/harvest coefficient estimates are only effective in calculating initial restoration effects and cannot be used for determining theoretical harvest past 5-year post-restoration because there are no recent records, or available data, for restoration efforts from a period longer than five years that has not been negatively affected by some type of environmental disaster. Therefore, because Mississippi oyster resources have not fully recovered from the effects of the 2011 BCS opening, the 5-year trend data from 2015-2019 is not entirely representative of the production capabilities of the Mississippi oyster reefs under normal conditions.

Resulting from the multiple 2019 openings of the BCS, not only were current market-sized oysters lost to the fishery, but multiple size classes of oysters were lost that were representative of future harvest for years to come. Table 13 uses the restoration/harvest coefficient to calculate theoretical harvest over a 3-year time period that represents the years subsequent size classes of oysters from the restoration areas would have grown to market-sized and been available to commercial harvest under normal environmental conditions. This allows MDMR to use real restoration efforts and measurable data collected from those efforts, to place a value on all size classes of oysters that were lost during the 2019 BCS opening, even those sub-market size classes.

As a result of the 2019 BCS openings and based on the cumulative impacts of the BCS openings in 2016, 2018 and twice in 2019, the State of Mississippi and its citizens have directly sustained negative impacts to its oyster and fisheries resources. The state has lost approximately \$9,300,000 on oyster restoration projects that had been completed in 2017 and 2018, around \$2,023,425 in dockside sales from existing market-sized commercial oyster resources, and future losses to market-sized commercial oyster

resources that are estimated to cost the state up to \$23,856,453.14 in lost revenues during the next three (3) years. Based on this assessment, the State of Mississippi's oyster and fisheries resources have been impacted by an estimated total of \$35,179,878, which doesn't take into consideration the value of the ecosystem productivity oysters provide to the environment, or how their loss negatively impacts other fisheries that depend on them. The decreased harvest could warrant the Mississippi Blue Crab fishery to be considered harmed, disrupted or failed, per the requirements of the National Marine Fisheries Service Policy Guidance for Disaster Assistance Under Magnuson-Stevens Act 312(a) and Interjurisdictional Fisheries Act 308(b) and 308(d). Oysters are a keystone species in Mississippi estuarine ecosystems and their value cannot only be measured in dollars but should be considered in other ways as well.

The serious disruption affecting the future production of oyster reefs in the Mississippi sound as well as the loss of harvestable biomass on said reefs, should warrant the Mississippi oyster fishery to be considered harmed, disrupted or failed, per the requirements of the National Marine Fisheries Service Policy Guidance for Disaster Assistance Under Magnuson-Stevens Act 312(a) and Interjurisdictional Fisheries Act 308(b) and 308(d).

Year (post-restoration)	Cumulative cultch placement volume (yd ³)	Oyster landings (# sacks)	Linear Trend (theoretical harvest)	Restoration/Harvest coefficient (theoretical landings/yd ³)
2006 (0)	14,375	0	0	0
2007 (1)	73,745	325	62,043	0.841318055
2008 (2)	122,385	116,749	161,750	1.321648895
2009 (3)	122,385	385,949	261,457	2.136348409
2010 (4)	122,385	305,722	361,164	2.951047923
2011 (5)	122,385	0 ¹	460,871	3.765747436

¹No 2010-2011 oyster season due to Deepwater Horizon oil spill. BCS opened in May 2011.

Table 12: Comparative analysis of restoration effort data vs. oyster landings data during the time period immediately following Hurricane Katrina in 2005. This analysis calculates linear trend and calculation of restoration/harvest coefficient.

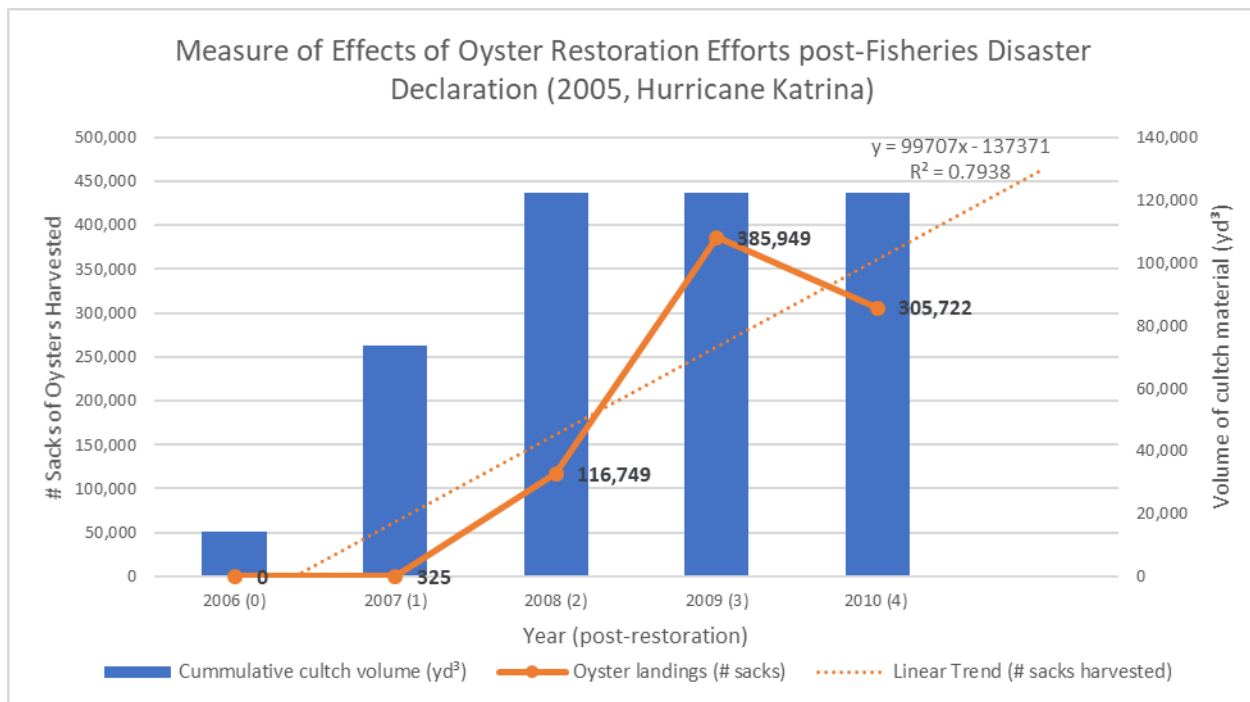


Figure 1: Plot further illustrates the comparative analysis of restoration effort data (volume of cultch) vs. oyster landings data (#sacks harvested) during the time period immediately following Hurricane Katrina in 2005. This plot shows the R^2 value and illustrates how the linear trend and restoration/harvest coefficient were derived.

Effectuated Years (post-restoration)	Cumulative cultch volume (yd³)	Restoration/Harvest coefficient (landings/yd³)	Theoretical Harvest (# sacks/year)	Economic Value (\$/year) ¹
2019 (2)	82,718	1.32165	109,324	4,919,586.90
2020 (3)	82,718	2.13635	176,714	7,952,151.05
2021 (4)	82,718	2.95105	244,105	10,984,715.19
TOTAL				23,856,453.14

¹based on \$45/sack primary point of sale

Table 13: Estimates initial future impacts to oyster resources related to restoration efforts and later future impacts based on 5-yr trends during normal environmental conditions during years not effected by fisheries disasters.

Mississippi Oyster Aquaculture Impacts

In 2018 the Mississippi Department of Marine Resources (MDMR) began training local residents in the new “Off-Bottom Oyster Aquaculture Program.” The program provides potential and current oyster farmers in Mississippi a foundation of knowledge to start and/or improve their oyster farming operation. The course covers oyster biology, hatchery basics, nursery options, seed handling, farm site selection, overview of off-bottom culture gear, methods to control fouling, splitting and grading, business planning, risk management, permitting, public health considerations and marketing. Each participant received approximately 10,000-12,000 oyster seed to gain hands-on experience with oyster culture and the opportunity to use one “run” of oyster farming gear within the Deer Island Oyster Aquaculture Park. Upon completion of Phase 1 of the program, participants leased acreage from the state and began their off-bottom oyster aquaculture business. During this time, the participants had approximately 160,000 oysters growing in the Deer Island Oyster Aquaculture Park.

Participants began selling oysters in March 2019 with the local wholesale/retail industries quickly purchasing product. On May 7, the MDMR was notified that the BCS would be opened for a second time in 2019. MDMR partners with U.S. Geological Survey to operate real-time hydrological stations and monitors the salinity at the Deer Island Oyster Aquaculture Park. Traditionally, the salinity at the Deer Island site ranges between 10-25 parts per thousand (ppt). MDMR staff documented salinity well below 5.0 ppt. Salinity remained low for multiple weeks in summer of 2019.

MDMR staff received notice from program participants of significant oyster mortality on May 29, 2019. MDMR staff analyzed a sample bag from the Deer Island Aquaculture Park and documented a 55% loss. Staff continued to monitor the oysters until August 2019. A total of 1,794 oysters were sampled with 73% overall mortality.

The future impacts of the freshwater to the off-bottom oyster industry are detrimental. The 2018 class consisted of 13 participants with all participants leasing acreage from the state. The mortality event not only caused a loss in 2019 but also eliminated their ability to reinvest in their new businesses for future years. MDMR expected the 2018 class to develop individual leases with the potential to grow up to 150,000-200,000 oysters per acre per year.

The average number of oysters produced per acre is 175,000 and the price per oyster is \$0.75. Each participant has 1-acre. For the 13 participants, this is a total loss of approximately \$1,706,250 dollars to the new off-bottom oyster industry.



Bonnet Carré Spillway Opening Damage Assessment

The opening of the Bonnet Carré Spillway (BCS) for 123 days this year created very real issues for the Mississippi Gulf Coast. The deaths of dolphins and sea turtles, diminished and death of the oyster, crab and shrimp crops and the closing of the coastal beach front. These issues with their vivid visuals and national publicity will impact the economy of the Gulf Coast long after the tangibles are gone. The following report compiled by Strategic Planning & Consulting LLC is a supplement to the Mississippi Department of Marine Resources report on commercial fisheries landing impacts. This report covers the disaster impacts of seafood dependent economic losses.

Industry	Revenue Losses
Seafood Restaurants	15,203,334
Shrimp Processors	16,181,595
Oyster Processors	66,413,710
Blue Crab Processors	1,132,750
Seafood Markets	9,755,912
Charter Boats	4,536,000
Bait Shops	1,176,766
Tackle Shops	8,392,540
Total	122,792,607

Seafood Restaurants Fishery Disaster Impacts

Losses To-Date

The restaurant industry on the Mississippi Gulf Coast was on pace for a 5% year-over-year growth rate. This growth remained constant through the openings of the BCS until the sub-set from the openings resulted in the Habitual Algal Bloom (HAB) and the following local and national publicity. With the exception of Jackson County, the least impacted because it is the eastern-most of the three counties on the Gulf Coast, this growth was reduced by half beginning in July 2019. See Table 14 comparing 2019 Season Growth March – July vs. July 2019 for each Gulf Coast county. See also the Calendar of Important Dates in Figure 2.

Month	Hancock	Harrison	Jackson
2019 Season March-July 2019	+8%	+5%	+5%
Jul-19	+4%	+3%	+8%

Table 14. Seasonal Restaurant Growth by County for 2019 vs. July 2019

Source: Sales tax revenues from the Mississippi Department of Revenue

Monthly Gross Sales and Collections for Coastal Counties for Restaurants and Other Eating Places reported by the Mississippi Department of Revenue (DoR) support this growth trend capping at 8.25% growth in June 2019 followed by a precipitous fall to 1.35% in August. See Table 15.

Month	2018	2019	%
March	63,593,426	65,327,556	2.72
April	76,370,825	81,644,109	6.90
May	70,469,884	75,353,921	6.93
June	73,703,757	79,786,502	8.25
July	75,859,600	79,769,319	5.15
August	75,727,904	76,754,481	1.35
September	68,351,962 *	74,013,062	8.28

Table 15. Gross Sales by month for Coastal Counties 2018 vs. 2019

Source: DoR

*The Labor Day Weekend in September 2018 was negatively impacted by the landfall of Tropical Storm Gordon on the Mississippi-Alabama line.

Assuming that the growth of the restaurant industry on the Mississippi Gulf Coast stabilized at the June growth percent of 8.25%, the difference between a projected 8.25% growth from 2018 and actual 2019 revenues for the months of July – September should be an accurate measure of the lost revenues of the industry to date. See Table 16.

Month	2018	2018+8.25% growth	2019 actual	Difference
July	75,859,600	82,118,017	79,769,319	2,348,698
August	75,727,904	81,957,456	76,754,481	5,220,975
September	73,000,000*	79,022,500	74,013,062	5,009,438
2019 loss-to-date				12,579,111

Table 16. Sustained growth at 8.25% vs. actual 2019 growth

*Adjusted to 1.35% to compensate for Tropical Storm Gordon

Projected Losses

History has demonstrated that the impact of events such as the opening of the BCS and the BP spill do not quickly go away. Economists opine that a three- to four-year period is required for recovery. The national media regarding the quality of the seafood on the Mississippi Gulf Coast will continue to depress the restaurant industry. Maintaining a period of flat growth is a reasonable assumption. A comparison of FY'2018 revenues to FY'2019 revenues and assuming no growth from 2018 should be an accurate predictor of lost revenues until FY'2020. See Table 17.

County	FY'2018	FY'2019	Projected loss
Harrison	30,973,118	32,589,594	
Hancock	3,966,017	4,482,728	
Jackson	12,348,096	12,869,732	
Total	47,317,831	49,942,054	2,624,223

Total Losses

Table 17. FY'2018 restaurant revenues compared to FY'2019 restaurant revenues

Source: DoR

The actual losses from July 2019 to September 2019 (**-\$12,579,111**) were combined with the projected losses until FY'2020 (**-\$2,624,223**) to estimate a total loss of seafood restaurant revenues of **-\$15,203,334**.

Shrimp Processors Fishery Disaster Impacts

Losses To-Date

Mississippi has five shrimp processors. They belong to the American Shrimp Processors Association, an organization of 30 companies that process shrimp from the Gulf of Mexico and the South Atlantic fisheries. Shrimp processing is a value-added industry, increasing the value of head-on ex-vessel shrimp as they are processed into finished shrimp (headless, peeled and deveined). These Mississippi processors annually produce approximately 25,000,000 pounds of finished shrimp.

According to industry sources, shrimp caught by the near-shore Gulf boats account for 20-25% of the shrimp processed in Mississippi. This was a catastrophic year for the Gulf boats. This resulted in reduced production by the Mississippi vendors. Table 18 contains data obtained from three of the Mississippi processors showing that production of finished shrimp for the period January thru July from 2018 to 2019 was reduced by -18%. This production loss, if representative of the entire annual production in Mississippi, would result in a reduction of finished shrimp product of 5,000,000 to 6,250,000 pounds.

2017	2018	Avg '17 & '18	2019	% change
12,308,911	12,861,386	12,585,148	10,296,387	-18%

Table 18. January – July 2018 production of finished shrimp vs. January – July 2019 production of finished shrimp

Source: American Shrimp Processors Association

Those same industry sources indicate that Mississippi processors annually produce 5,000,000 – 6,000,000 pounds of finished shrimp from the near-shore Gulf boats. The industry uses a factor of 0.625 to compute the loss of weight when head-on shrimp are converted to headless shrimp. An additional 10% of weight is lost when the shrimp are peeled, resulting in a final factor of 0.5625 to calculate the weight of finished shrimp produced from head-on shrimp. Based upon DMR collection data, total shrimp landings for the years 2014, 2015 & 2017 averaged 10,577,043 pounds. Using the weight loss factor above, this represents 5,949,586 pounds of finished shrimp.

Landings data for Mississippi for 2019 was 4,390,205 pounds, leaving a difference of 6,186,838 pounds. Applying the same weight loss factor of 0.5625, this reduction in product results in a shortage of 3,479,913 pounds of finished shrimp. Based upon September 2019 wholesale prices provided by the American Shrimp Processors Association for peeled and deveined finished shrimp, valued at \$4.65/lb., this results in a loss of -\$16,181,595 to the Mississippi processors.

Projected Losses

The loss of shrimp product closely parallels the Deep Water Horizon event. Not only has the industry lost product, but it has had a dramatic effect on the inventory size distribution of product in inventory. Most processors have large gaps in product inventories, shifting the size of shrimp in storage to larger sizes. As in the oil spill event, these gaps will result in lost customers in both the long and short term. A lost customer in today's market must be bought back via lower than market prices over the coming years. U.S. market share will again shrink and be lost to imported product.

Unlike the oil spill, prices did not increase on the domestic market in this disaster. The increase in imports quickly exceeded the demand resulting in stable wholesale prices and a surplus of shrimp in the U.S. market.

While it is not feasible to project future losses, it is a certainty that there will be significant losses in the future.

Total Losses

Losses To-Date of **(-\$16,181,595)** have to be combined with Projected Losses to get a comprehensive picture of the Total Losses to the Mississippi Shrimp Processors. Those Projected Losses will most likely exceed the Losses To-Date.

Oyster Processors Fishery Disaster Impacts

Losses To-Date

Three companies have shared sales and quantity data which should allow for an overview of the impact on the oyster processing industry. These three companies closely approximate 100% of the oyster processing industry in Mississippi. The companies will be identified as #1, #2 and #3. #1 is primarily a fisherman with moderate processing. #2 is solely a processor of oyster, crabs and shrimp. For analysis purposes, #2 shall be evaluated only on oyster processing. #3 is primarily a processor selling fresh and IQF products.

#1 reports sales data for years 2016 and 2019 reflecting quantity and price. See Table 19.

Inventory	2016			2019		
	Quantity	Amount	Price	Quantity	Amount	Price
LA Mini Sacks	35,713	1,096,318	30.70	47,744	1,560,592	32.69
LA Sacks	137,653	7,058,632	51.28	12,163	748,766	61.56
MS Sacks	<u>22,330</u>	<u>1,052,336</u>	47.13	<u>-</u>	<u>-</u>	-
Total	195,696	9,207,286		59,907	2,309,358	

Table 19. #1 Sales data for 2016 vs. 2019

This data allows for a comparison of sales for #1 for 2016 vs. 2019. See Table 20.

Sales	2016	2019	Difference	%
Total Quantity	195,696	59,907	135,789	-69%
Amount	9,207,286	2,309,358	6,897,928	-75%

Table 20. Comparison of Sales data for #1 for 2016 vs. 2019

#1 has suffered a Loss To-Date of **-\$6,897,928**.

Data supplied by #2 includes Gross Sales for 2014 and 2019 and percent of sales by species. Gross Sales data is reflected in Table 21.

Year	Sales	Cost	Cost as % of Sales
2014	1,649,101	1,100,000	66.7%
2019	<u>645,832</u>	<u>470,000</u>	72.8%
Difference	1,003,269	630,000	
% loss	-61%	-57%	

Table 21. #2 Sales for 2014 vs. 2019

Source: data from #2

Sales by #2 are divided by species as follows: oysters 25%, crabs 37.5% and shrimp 37.5%. Therefore, the Loss To-Date for oyster processing by #2 is 25% of the difference of Sales in Table 22, or **-\$250,817**.

#3 provided sales and quantity data for January thru October for the years 2015 and 2019. See Table 22.

Sales	2015	2019	Difference	%
Purchases	7,310,900	5,279,795	2,031,105	-27.8%
Sales	13,499,085	9,566,210	3,932,875	-29.1%

Table 22. #3 Sales and Quantity for Jan – Oct 2015 vs. 2019

Source: #3 data

#3 has suffered a Loss To-Date of **-\$3,932,875**.

The total Losses To-Date for #1, #2 and #3 combined is **-\$11,081,620**.

Projected Losses

In 2019 #2 entered into a business relationship with Prestige Oysters operating out of Texas. Prestige operates approximately 100 vessels fishing private leases. As a result, they fish all year with the exception of an annual two-week vacation, delivering oysters approximately 350 days a year. #2 was 15 days into buying from Prestige when the freshwater intrusion from the BCS opening ceased operations. Purchases for those 15 days were \$100,030. The average daily cost for the purchases from Prestige was \$6,669. Assuming that the Cost as a % of Sales of 66.7% for 2014 is representative, the resulting daily Sales from the Prestige relationship is \$9,999. Variables such as weather can interfere with delivery, so an 80% factor is applied to the 350 days. The total annual sales from this relationship would be **\$2,799,720**.

Processor #3 relies heavily on it's IQF business. Inventory from the previous year is sold and replenished with new product. In this case, the inventory has been depleted and there will be significantly reduced sales in subsequent years. This represents 33.8% of sales. Applying this percentage to 2015 Gross Sales of \$13,499,085, a projected annual loss of **-\$4,562,690** results.

Predictions for recovery of the oyster fishery begin at three years. Combining the Losses To-Date above of **-\$11,081,620** with the loss of the Prestige Oyster business by #2 of **-\$2,799,720** and the IQF lost sales of **-\$4,562,690** by #3 for an annual total Projected Loss of **-\$18,444,030** recurring for three years the resulting Projected Loss is **-\$55,332,090**.

Total Losses

Combining Losses To-Date of **-\$11,081,620** with the Projected Loss of **-\$55,332,090** equals a Total Loss of **-\$66,413,710**.

Blue Crab Processors Fishery Disaster Impacts

Losses To-Date

NOAA Processor Data Estimates of sales of blue crabs for 2017 and 2018 yields an average of \$1,648,116 per year. This estimate is based upon the 8 licensed processors in Mississippi. We have sales data for 2019 from one of these processors (Processor X) that it is estimated is responsible for 47% of all sales of blue crabs. Applying this 47% to NOAA's estimate of average sales results in \$774,615 of historical annual sales by Processor X.

Processor X reports Gross Sales in 2019 of \$645,832, of which 37.5% is attributed to sales of blue crabs. This computation yields \$242,187 in sales of blue crabs in 2019 by Processor X. Table 23 compares Processor X's historical sales vs. 2019 sales of blue crabs.

Processor	Historical Annual Sales	2019 Sales	Difference	% loss
X	774,615	242,187	532,428	-68.73%

Table 23. Processor X Historical Sales vs. 2019 Sales of Blue Crabs

Source: NOAA Processor Data Estimates & Processor X data

This -68.73% loss of sales by Processor X can then be applied to the average sales per year from the NOAA Processor Data Estimate of \$1,648,116. The resulting Losses To-Date for the Blue Crab Fishery is **-\$1,132,750**.

Projected Losses

It is projected that the blue crab fishery will not suffer any future damage resulting from the opening of the BCS.

Total Losses

Total Losses are limited to the Losses To-Date of **-\$1,132,750**.

Seafood Markets Fishery Disaster Impacts

Losses To-Date

While there are a number of small Seafood Markets on the Mississippi Gulf Coast, the industry is dominated by six markets. They control virtually all of the wholesale market, which had the greatest impact from the BCS disaster. For purposes of analysis six markets will be used for calculations.

A sampling of one of these markets shows drastic reductions in sales April – July. See Table 24.

Category	April-July 2018	April-July 2019	% Change
Retail	281,748	278,608	-1%
Wholesale	1,182,762	889,135	-24%
Deli	45,307	36,422	-19%
Total	1,509,817	1,204,195	-20%

Table 24. Sales by category for April-July 2018 vs. April-July 2019

A month-to-month comparison of revenues from 2018 to 2019 reflects a continuing downward spiral with no end in sight. See Table 25.

Month	% of Revenue Change from 2018 to 2019
June	-32%
July	-27%
August	-27%
September	-35%

Table 25. Monthly comparison of percentage of revenue from 2018 to 2019

Using our sample marketplace, we can calculate its loss using 2018 revenues and the -20% loss of business from Table 1. This can then be extrapolated to cover the six markets we have identified as representing the industry for calculation purposes. See Table 26.

2018 Revenue for Sample	4,064,963
% Change from 2018-2019	X 0.20
2019 Loss for Sample	812,993
Industry	X 6
Total Industry Loss	4,877,956

Table 26. Calculation of Revenue Impact for Seafood Markets on the Mississippi Gulf Coast

Projected Losses

The extensive negative national publicity regarding the quality of Mississippi's seafood combined with the continuing negative downward trend in revenues leads to a realistic assumption of similar Losses for the next calendar year **(-\$4,877,956)**.

Total Losses

The Losses To-Date **(-\$4,877,956)** were combined with the Projected Losses **(-\$4,877,956)** to estimate a Total Loss of Seafood Market revenues of **-\$9,755,912**.

Charter Boats Fishery Disaster Impacts

Losses To-Date

The charter boat fleet is generally divided into three categories: the larger Biloxi Harbor trolling and offshore vessels, the middle region with mixed trips and Chandeleur trips out of Gulfport and the Western fleet fishing bay boats out of Hancock County and Pass Christian Harbor. The Western end of the Gulf Coast was the first to be influenced by the fresh river water resulting from the BCS opening. Captains operating in this region experienced early monthly declines of as much as 40% to 47%. On the other end of the Coast in Biloxi Harbor Captains experienced seasonal drops of 20% to 25%. The month of May was a highlight as the red snapper season opened which is suited to their larger offshore vessels.

A survey of several Captains resulted in reports of lost income ranging from -21% to -56% with a couple selling their vessels and getting out of the business. No Captains reported an increase in business. Revenue losses were reported from \$12,000 to \$30,000 for the season. For purposes of calculation the average of the high and low reported income losses will be used **(-\$21,000)**. There are 108 licensed Captains in Mississippi. Table 27 is a calculation of the lost revenue based upon this data.

Average Lost Revenue	\$21,000.00
# of Captains	X 108
	\$2,268,000.0
Losses To-Date	0

Table 27. Calculation of Losses To-Date

Sources: DMR and survey

An additional metric that reflects the decline of the charter boat business is the number of calls to the business. 1-800 numbers generate monthly call logs which is used as the source of this data. Table 28 charts calls in 2018 vs. 2019.

2018	2019	% Change
887	445	-50%

Table 28. Telephone calls in 2018 vs. 2019

Source: 1-800 logs

Projected Losses

The reported trip logs reflect a continuing decline in the Charter Boat industry. The anticipated 2- to 3-year recovery will most likely impact Charter Boats as expected for other segments of the fisheries industry. Projecting flat growth for the next year is a reasonable assumption which would result in a Projected Loss of **-\$2,268,000**.

Total Losses

The Losses To-Date (**-\$2,268,000**) were combined with the Projected Losses (**-\$2,268,000**) to estimate a Total Loss of Charter Boat Revenues of **-\$4,536,000**.

Bait Shops Fishery Disaster Impacts

Losses To-Date

Bait Shops on the Mississippi Gulf Coast were hard hit by the opening of the BCS. The loss of the shrimp crop devastated this industry. Further complicating the shops was that the bait tanks circulate water from the harbor which was oxygen depleted and killed the minnows. They were now left with no live bait. A sample of revenue numbers from a shop demonstrates the severity of the issue. See Table 29.

Month	2018	2019	Difference	%
April	10,655	3,840	6,815	-63%
May	33,260	7,258	26,002	-78%
June	26,855	9,225	17,630	-65%
July	<u>21,380</u>	<u>11,480</u>	<u>9,900</u>	-46%
Total	92,150	31,803	60,347	-65%

Table 29. Revenue from a sample bait shop for 2018 vs. 2019

Source: Sales tax records

There are 13 licensed bait shop dealers on the Gulf Coast. Assuming that this sample is representative of the group, a simple calculation can give us Losses To-Date. See Table 30.

Sample Revenue Loss	60,347
# of bait shop licenses	x 13
Losses To-Date	-\$784,511

Table 30. Calculation of Bait Shop Losses To-Date

Sources: DoR sales tax records and DMR license records

Projected Losses

Live bait dealer tickets maintained by the Mississippi Department of Marine Resources (DMR) show that the number of purchasers continues to decline in August. Bait Shops are seasonal. Therefore, an assumption that these losses will continue for an entire year need to be modified to reflect six months of losses at **-\$392,255**.

Total Losses

The Losses To-Date (**-\$784,511**) were combined with the Projected Losses (**-\$392,255**) to estimate a Total Loss of Bait Shop revenues of **-\$1,176,766**.

Tackle Shops Fishery Disaster Impacts

Losses To-Date

The U.S. Fish & Wildlife Service's 2016 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation reports that the average saltwater angler will spend \$324 per year on fishing equipment. That is money they are not spending if they are not fishing. In Mississippi there are 57,562 resident licensed saltwater anglers.

A method to measure the impact of the opening of BCS on this spending is to sample a merchant servicing these anglers. Table 31 tracks monthly sales for 2014 vs. 2019 of a Gulf Coast Tackle Shop.

Month	2014	2019	%
March	28,107	17,321	-38%
April	59,602	24,495	-59%
May	75,130	33,581	-55%
June	60,705	33,781	-44%
July	47,359	28,228	-40%
August	38,397	27,025	-30%
September	<u>33,491</u>	<u>25,313</u>	-24%
Total	342,791	189,744	-45%

Table 31. Monthly revenue for a sample tackle shop for 2014 vs. 2019

This Tackle Shop's reduced revenues of -45% are representative of fishing expenditures by saltwater anglers in general. Table 32 is a calculation projecting the impact on that spending by MS licensed saltwater anglers resulting from the opening of the BCS.

Expenditure per Angler	\$324
% Reduction	X 0.45
Reduced Expenditure	<u>\$145</u>
# of MS Anglers	X 57,562
Total Reduced Spending	\$8,392,540

Table 32. Calculation of the impact on Mississippi saltwater angler expenditures

Projected Losses

Once the conditions for saltwater fishing return to normal there is no reason to anticipate any continued losses.

Total Losses

The Losses To-Date is the Total Losses as no Projected Losses are anticipated.

-\$8,392,540

2019

JANUARY

s	m	t	w	t	f	s
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

FEBRUARY

s	m	t	w	t	f	s
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28		

MARCH

s	m	t	w	t	f	s
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

APRIL

s	m	t	w	t	f	s
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30				

MAY

s	m	t	w	t	f	s
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

JUNE

s	m	t	w	t	f	s
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

JULY

s	m	t	w	t	f	s
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

AUGUST

s	m	t	w	t	f	s
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30
31						

SEPTEMBER

s	m	t	w	t	f	s
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30					

OCTOBER

s	m	t	w	t	f	s
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

NOVEMBER

s	m	t	w	t	f	s
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

DECEMBER

s	m	t	w	t	f	s
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

Bonnet Carre' Spillway Open

Habitual Algal Bloom

TS Barry

Figure 2. Calendar of Important Dates